

REMARKS/ARGUMENTS

Reconsideration of this application is requested. Claims 64, 66 and 71 are pending in the application subsequent to entry of this Amendment.

Claim 64 is above amended for purposes of clarity and to further distinguish applicants' claims from the documents cited and applied in the Official Action.

The Official Action raises three issues, one of obviousness-type double patenting and two of alleged "obviousness" over two or in some cases three documents. Counsel will address these rejections on the basis of the examiner's comments and citations in the obviousness-type double patenting rejection. These observations also carry through to the rejections made under 35 USC § 103(a) and also demonstrate the deficiencies in these two further rejections.

Claims 64, 66 and 71 have been rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-12 of U.S. patent no. 5,652,434 (the '434 patent) in view of Edmond et al (U.S. 5,592,501) and Mannou et al (U.S. 5,270,246).

As to claim 64:

The device of claim 64 has an n-type layer and a first p-type clad layer. The n-type layer comprises an n-type GaN or n-type nitride semiconductor containing indium and gallium. The first p-type clad layer comprises a p-type InGaN. An active layer of a multi-quantum well structure is provided between the n-type layer and the first p-type clad layer. Further, a second p-type clad layer is formed over the first p-type clad layer. The second p-type clad layer is made of a p-type AlGaN.

The '434 patent discloses a gallium nitride-based III-V Group compound semiconductor device having an n-type semiconductor layer and a p-type semiconductor layer. The n-type and p-type semiconductor layers may be made of $\text{In}_x\text{Al}_y\text{Ga}_{1-x-y}\text{N}$, where $0 \leq x \leq 1, 0 \leq y \leq 1$, and $x + y \leq 1$. In addition, as clearly defined in claim 1 of the '434 patent, the n-type and p-type semiconductor layers are provided on the same side of the

substrate and therefore the first and second electrodes are provided on the same side of the substrate as the n-type and p-type layers. Thus, the device of the '434 patent is a so-called horizontal device. In order for current to flow over a large area in the horizontal device, the '434 patent arranges the first electrode layer at a position farthest from the bonding pad, which is connected to the second electrode which is provided over an entire surface of the p-type semiconductor layer.

The n-type and p-type semiconductor layers of the '434 patent are contact layers with which the first and second electrodes contact, respectively, as clearly defined in claim 1 of the '434 patent. The '434 patent does not disclose or suggest a clad layer, which serves to confine carriers or light. The clad layer and the contact layer are completely different layers in function. Moreover, the '434 patent does not specifically disclose or suggest using its p-type semiconductor layer by a p-type InGaN. The devices of the present invention provide significant advantages -- an InGaN layer can serve as a buffer layer and allows a good quality crystal to grow on it, and the active layer can be made thin without cracks being formed therein, as discussed on page 44, line 12 to page 46, line 7 of the present specification.

Edmond et al. discloses a so-called vertical device in which contacts are provided on opposite sides of a conductive substrate (see column 3, lines 20-21). Edmond et al. uses an SiC substrate, which is an electrically conductive material, to provide such a vertical device.

Considering the above, it is therefore illogical to combine the '434 patent, relating to a horizontal device, with Edmond et al., relating to a vertical device.

Mannou et al. discloses a semiconductor laser having a first p-type clad layer 44 and a second p-type clad layer 46. However, these clad layers are made of AlGaInP, which is not a nitride semiconductor, and it contains In. In addition, the first and second p-type clad layers 44 and 46 are of the same composition, as is clearly indicated at column 3, lines 57-58 of Mannou et al., which reads, "The growth conditions in the second MOVPE growth are the same as those in the first MOVPE growth."

On the contrary, in the device of claim 64, the first p-type clad layer comprises a p-type InGa_N, and the second p-type clad layer is made of a p-type AlGa_N. The differences are apparent.

Further, the examiner asserts that Mannou et al. teach the multiple cladding layers would suppress diffusion of dopants and would increase yield of the device, referring to column 1, lines 62-66 of Mannou et al. However, the effects that diffusion of dopants is suppressed and yield of the device is increased are not the results of the multiple cladding layers, but the results of providing a current blocking layer 45 doped with both p-type and n-type dopants (see column 4, lines 1-12 of Mannou et al.). The examiner's interpretation of Mannou is inconsistent with the reference itself.

As is clear from the above discussions, claim 64 of the present application is not obvious from the '434 patent in view of Edmond et al. and Mannou et al.

As to claim 71:

The device of claim 71 of the present application has two n-type clad layers, in addition to the two p-type clad layers of claim 64. Therefore, the same arguments as described above would apply to the patentability of claim 64. Further, claim 66 is patentable since it depends on claim 71.

Claims 64, 66 and 71 have been rejected under 35 USC 103(a) as being unpatentable over Edmond et al. in view of Mannou et al. Applicants have already addressed the deficiencies in the Edmond and Mannou et al references in the above discussion and for these reasons, withdrawal of the rejection directed to claims 64, 66 and 71 is appropriate.

Finally, claim 66 is rejected as being unpatentable/obvious over Edmond, discussed above "as modified by" Hayakawa et al U.S. 4,759,024 "as applied to claim 63 above" further in view of Chai U.S. 5,625,202. The rejection as stated is unclear in that there is no claim 63 currently pending in this application nor is Hayakawa et al '024 discussed in any of the preceding rejections. Counsel does observe the examiner's comment on page 7 of the Official Action "(The) Hayakawa et al (reference) is no longer

NAKAMURA et al.
Appl. No. 09/809,038
January 16, 2004

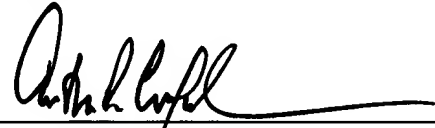
used in the present Office Action ...". Deficiencies in the rejection aside, applicants submit that claim 66 is patentable in its own right as well as by virtue of its dependency from patentable claim 71.

Reconsideration and allowance of claims 64, 66 and 71 are solicited.

Respectfully submitted,

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